

CLAIMS

1. A process for forming a resistance welding electrode comprising the steps of:

5 providing a billet formed from a high conductivity metal, said billet including a first portion having a first inner cavity therein;

inserting a dispersion strengthened copper insert into said first inner cavity of said billet thereby forming an insert-containing billet; and

10 deforming said insert-containing billet so as to mechanically lock said insert in place in said billet, said deformed insert-containing billet comprising a resistance welding electrode.

2. A process as set forth in claim 1, wherein said step of providing a billet comprises the steps of:

5 providing a generally cylindrical cut-off portion of high conductivity copper; and

upsetting and forward extruding said cut-off portion so as to form a billet having a first inner cavity therein.

3. A process as set forth in claim 2, wherein said upsetting and forward extruding step comprises the steps of:

5 locating said cylindrical cut-off portion adjacent to an inner cavity of an upsetting and forward extruding die, said inner cavity being open at one end and having an inner diameter substantially equal to an outer diameter of said billet, said die including a forming pin located axially within said inner cavity and extending into said inner cavity from an end opposite to said open end of said inner cavity, said pin having an outer diameter 10 substantially equal to an inner diameter of said billet first inner cavity;

inserting said cut-off portion into said inner cavity via an insertion pin; and

15 applying pressure to said cut-off portion via a punch to cause forward extrusion of said cut-off portion over said pin, whereby a billet is formed having an outer diameter which is greater than an outer diameter of said cut-off portion and including a first inner cavity.

4. A process as set forth in claim 1, wherein said deforming step comprises the steps of:

5 placing said insert-containing billet into a first inner cavity of a first insert-containing billet forming die, said first inner cavity having a first generally rounded lower portion;

10 applying pressure with a first forming punch to a second portion of said insert-containing billet such that said insert-containing billet is initially deformed so as to have a first shape;

15 placing said insert-containing billet having said first shape into a second inner cavity of a second insert-containing billet forming die, said second inner cavity having a second generally rounded lower portion;

20 applying pressure with a second forming punch to said second portion of said initially deformed insert-containing billet such that said initially deformed insert-containing billet is further deformed so as to have a second shape;

25 placing said insert-containing billet having said second shape into a third inner cavity of a third insert-containing billet forming die; and

applying pressure with a third forming punch to said second portion of said further deformed insert-containing billet such that said further deformed insert-containing billet is additionally deformed so as to have a third shape, said insert of said additionally deformed insert-containing billet having a substantially hourglass shape such that said insert is mechanically locked in place within said billet.

5. A process as set forth in claim 4, wherein said steps of applying pressure with said first, second and third forming punches effects the formation of a second inner cavity in said second billet portion via back extrusion.

6. A process as set forth in claim 1, further comprising the step of staking said first portion of said billet after said inserting step and before said deforming step.

7. A resistance welding electrode comprising:
a main body formed from a high conductivity metal and including a first portion having a first inner cavity; and
a dispersion strengthened copper insert provided in
5 said first inner cavity, said main body first portion and said insert being ^{deformed} shaped such that said insert is mechanically locked in place in said main body.

8. A resistance welding electrode as set forth in claim 7, wherein said insert is shaped substantially like a hyperboloid and said inner cavity has a substantially similar shape.

9. A resistance welding electrode as set forth in claim 7, wherein said main body further includes a second inner cavity provided in a second portion of said main body and which is adapted to be supplied with a cooling fluid during a resistance
5 welding process.

10. A resistance welding electrode as set forth in claim 7, wherein said insert is formed from an internally oxidized copper-aluminum alloy.

11. A resistance welding electrode as set forth in claim 7, wherein said main body is formed from a high conductivity copper.

12. A resistance welding electrode as set forth in claim 7, wherein said main body is formed from a silver bearing copper.

13. A resistance welding electrode formed from a process comprising the steps of:

providing a billet formed from a high conductivity metal, said billet including a first portion having a first inner cavity formed therein;

inserting a dispersion strengthened copper insert into said first inner cavity of said billet thereby forming an insert-containing billet; and

deforming said insert-containing billet so as to mechanically lock said insert in place in said billet, said deformed insert-containing billet comprising a resistance welding electrode.

14. A resistance welding electrode as set forth in claim 13, wherein said step of providing a billet comprises the steps of:

providing a generally cylindrical cut-off portion of high conductivity copper; and

upsetting and forward extruding said cut-off portion so as to form a billet having a first inner cavity.

15. A resistance welding electrode as set forth in claim 13, wherein said upsetting and forward extruding step comprises the steps of:

locating said cylindrical cut-off portion adjacent to an inner cavity of an upsetting and forward extruding die, said inner cavity being open at one end and having an inner diameter substantially equal to an outer diameter of said billet, said die including a forming pin located axially within said inner cavity and extending into said inner cavity from an end opposite to said open end of said inner cavity, said pin having an outer diameter

substantially equal to an inner diameter of said billet first inner cavity;

inserting said cut-off portion into said inner cavity;
and

15 applying pressure to said cut-off portion via a punch to cause forward extrusion of said cut-off portion over said pin, whereby a billet is formed having an outer diameter which is greater than an outer diameter of said cut-off portion and including a first inner cavity.

16. A resistance welding electrode as set forth in claim 13, wherein said deforming step comprises the steps of:

placing said insert-containing billet into a first inner cavity of a first insert-containing billet forming die,
5 said first inner cavity having a first generally rounded lower portion;

applying pressure with a first forming punch to a second portion of said insert-containing billet such that said insert-containing billet is initially deformed so as to have a
10 first shape;

placing said insert-containing billet having said first shape into a second inner cavity of a second insert-containing billet forming die, said second inner cavity having a second generally rounded lower portion;

15 applying pressure with a second forming punch to said second portion of said initially deformed insert-containing billet such that said initially deformed insert-containing billet is further deformed so as to have a second shape;

20 placing said insert-containing billet having said second shape into a third inner cavity of a third insert-containing billet forming die; and

applying pressure with a third forming punch to said second portion of said further deformed insert-containing billet such that said further deformed insert-containing billet is
25 additionally deformed so as to have a third shape, said insert of

said additionally deformed insert-containing billet having an altered shape such that said insert is mechanically locked within said billet.

17. A resistance welding electrode as set forth in claim 16, wherein said insert of said additionally deformed insert-containing billet is shaped substantially like a hyperboloid.

18. A resistance welding electrode as set forth in claim 16, wherein said steps of applying pressure with said first, second and third forming punches effects the formation of a second inner cavity in said second billet portion via back 5 extrusion.

19. A resistance welding electrode as set forth in claim 13, wherein said billet is formed from a high conductivity copper.

20. A resistance welding electrode as set forth in claim 13, wherein said billet is formed from a silver bearing copper.

21. A resistance welding electrode comprising:
a main body formed from a silver bearing copper material and including a first portion having a first inner cavity; and

5 a dispersion strengthened copper insert provided in said first inner cavity.

22. An electrode as set forth in claim 21, wherein said main body first portion and said insert are shaped such that said insert is mechanically locked in said main body.